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# COMPARATIVE PROFITABILITY OF MANAGING *MELOIDOGYNE INCOGNITA* ON THE VEGETATIVE GROWTH OF CUCUMBERS (*CUCUMIS SATIVUS L.*) USING ROOT GROW (MYCORRHIZAL FUNGI) AND BROILER DROPPINGS

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**ABSTRACT**
Screen-house and field experiments were carried out to evaluate and compare the activities of Root grow (mycorrhiza fungi) and broiler droppings (singly and both) on root-knot nematode, *Meloidogyne incognita* infecting Cucumber, *Cucumis sativus* (L). The experiment was designed as a 2 by 5 factorial fitted into a Complete Randomised Design (CRD) and Randomized Complete Block Design (RCBD) for screen house and field experiments respectively. Two levels each of the two treatments were evaluated both in the screen house and on the field. Root-grow (mycorrhiza fungi) was evaluated at the rate of 0.5 g and 1.0 g while broiler droppings were evaluated at the rate of 50 g and 100 g. The effects of treatments on vegetative growth as well as nematode damage and population were determined both in the screen house and on the field. All data collected were subjected to Analysis of Variance (ANOVA) and where treatment means were significant, multiple comparisons of treatments were done using Tukey's honesty significant difference at a 5 % level of significance. Broiler droppings at 100 g and 50 g were more effective in controlling nematode than the two levels of Root grow (mycorrhiza fungi). Plant growth was best with broiler droppings at 100 g followed by broiler droppings at 50 g. Nematode population was reduced in all plant treated and were less galled compared with the control. The results showed that broiler droppings and mycorrhiza fungi can be used in controlling root-knot nematode *Meloidogyne incognita* on cucumber.

**Keywords:** *Meloidogyne incognita*; cucumber; broiler droppings; mycorrhiza fungi, plant growth

## INTRODUCTION

Cucumbers originated from India (south foot of the Himalayas), or possibly Northern Burma and Nepal, where the weather and the soil are very variable for the plant's vegetation and fruiting (Alan, 2014). From far Asia i.e. India, the plant spread quickly to China and it is much welcome and deeply appreciated by the ancient Greeks and the Romans. The famous explorer, Columbus was reputed to have brought the cucumber to the New World, along with many other vegetables. The plant was planted in Haiti and other islands in 1494 (Austin and Brendan, 2008). Cucumber (*Cucumis sativus L.*) is thought to be one of the most important and oldest vegetables around the globe cultivated by the man with historical dating as far back as 5000 years (Bhattarai and Prativa, 2011) and a popular member of the Cucurbitaceae family. The crop is the fourth most important vegetable after tomato, cabbage and onion in Asia (Eifediyi and Remison, 2010). Cucurbits are a family of healthy foods, cucumbers, in particular, are prime dieting food. The immature fruits are eaten raw in a salad or used pickled. The young leaves are also used as a salad or cooked vegetables. It is a very good source of vitamins A, C, K, B6, potassium, pantothenic acid, magnesium, phosphorus, calcium, copper, manganese and phosphorus (Vimala *et al.*, 2009). The ascorbic acid and caffeic acid contained in cucumber help to reduce skin irritation and swollen (Okonmah, 2011).

Amongst the objectives of Millennium Development Goals, to stamp out intense poverty and hunger stood out clearly. One of the major problems of this present time is the provision of enough food globally. One of the constant threats to this objective is huge yield loss yearly due to diseases, pests and natural disasters (Barker, 1985). Plant-parasitic nematodes account for most of this damage annually when compared to insect pests. Crop yield loss as a result of nematodes in many countries of the world is huge and enormous. They account for an estimated loss of about 13 % annually ($160 billion) globally (Luc *et al.*, 2005; Singh, 2013). The control and management of plant-parasitic nematode-related diseases are challenging and difficult, because of their hidden nature and hence, more often ignored. Besides, nematodes causing huge damage individually, they also form disease-complexes with many other micro-organisms hence increased crop yield loss. Synthetic nematicides are much used to control these plant-parasitic nematodes but most of these have been banned because of their associated risk to human health and the environment (Vermis and Roberts 1996; Bello *et al.,* 2013; 2013b; Izuogu *et al.,* 2018; Izuogu *et al.,* 2020).

Unlike chemical nematicides, organic amendments have little or no adverse effects on man and the environment and they are readily available. Examples of common organic amendments are organic manure / organic fertilizers, mycorrhiza fungi, crop residues after planting, bio-solids, saw-dusts. Root-grow, (a combination of arbuscular and ectomycorrhizal fungi) and organic manure i.e. broiler droppings are used in this study. Despite promising results with amendments i.e. arbuscular mycorrhiza (AM) fungi and poultry droppings in many studies and researches, some recommendations for their use against nematode problems such as root-knot nematodes (*Meloidogyne spp*.) on vegetables, are not very enthusiastic. Thus, there are some discrepancies between the many favorable reports of efficacy against plant-parasitic nematodes and some of the recent practical recommendations of using mycorrhizal fungi and poultry droppings (Zasada *et al*. 2010; Noling, 2009a; Noling, 2009b). It is possible under some conditions that the mycorrhiza fungi may cheat their host plant into supplying carbon with no apparent benefit to the plant which can cause a decline in growth (Burney *et al.,* 2010). Droppings from poultry, many claims are acidic which may affect the soil hence affect the plant too. Despite these discrepancies and ambiguities, there are few reports on the relationship between mycorrhiza fungi, poultry droppings and root-knot nematodes of cucumber. There is then the need to exploit the use of these amendments i.e. Root grow (mycorrhiza fungi) and poultry droppings i.e broiler droppings against root-knot nematodes i.e. *Meloidogyne incognita* on the cucumber plant. The use and acceptance of these amendments will be both economical and less tedious, therefore this is the thrust of this study.

## Material and Methods

### Site Description

The study was conducted at the University of Ilorin's teaching and research farm (8$^{o}$-29' N, 4$^{o}$-35'E) between August and November 2016.

### Collection of soil samples for determination of initial nematode population.

Ten grams (10 g) of soil samples were collected at a depth of 0-20 cm in a zig-zag pattern from the experimental plot. The soil sample was taken to the crop protection laboratory for nematode extraction and enumeration and to the International Institute of Tropical Agriculture (IITA), Ibadan for confirmation of the initial nematode population.

### Sources of treatments employed

The treatments used in the control of nematode infection include Root Grow (Mycorrhizal fungi) and Broiler droppings. The Root grow is a combination of both Ectomycorrhizal fungi and Endomycorrhizal fungi (Arbuscular mycorrhizal fungi). The (root grow) mycorrhizal fungi were collected from Plant-works Ltd, Unit 930 Comforth drive, kent science park, Sittingbourne, Kent ME9 8px, United Kingdom (UK). Broiler droppings were collected at a poultry house at Obbo road, Ilorin. The broiler droppings were allowed to cure for one month before pulverizing to powder.

### Source of Root-Knot nematodes and their development

Highly galled roots of *Celosia argentea* plants infected with root Knot nematodes were collected from a vegetable garden located within Kwara State College of Education Ilorin, Ilorin, Kwara State. Root galls induced by *Meloidogyne incognita* on the entire root system were rated according to Bridge and Page (1980)

### Source of Cucumber Seeds

The seeds of two different Cucumber Varieties were purchased from an Agro-Chemical shop along Amilegbe road, Ilorin Kwara State. The two varieties include Market more and Marketer.

### Screen house experiment

### Soil sterilization

Topsoil was collected behind the pavilion at the faculty of Agriculture, University of Ilorin, Ilorin. The soil was sieved and heated in a metal container for twenty-four hours and allowed to cool. The soil was transferred after cooling into fifty perforated seven-liter buckets. The buckets were arranged on blocks to avoid contamination from the ground.

### Experimental design

The experimental design was a factorial type fitted into a Complete Randomised Design (CRD). The two factors considered were two varieties and five treatments giving a total of ten treatments

### Planting and management

Three Cucumber seeds were planted in each of the perforated buckets filled with sterilized soil. The plants were later thinned to one plant per bucket. The buckets were labeled and randomly arranged in the screen house. Ten grams (10 g) of root galls were chopped and inoculated in each pot to increase the initial nematode population of the soil. Each treatment was replicated five times. The plants were watered daily with clean water.

### Application of treatments

Root-grow (mycorrhiza fungi) and broiler droppings were applied to the two varieties of Cucumber plants at two different levels. Root-grow (mycorrhiza fungi) was applied at 0.5 g and 1.0 g (The recommended rate of application by the producer). Broiler droppings were applied at 50 g and 100 g. Each treatment was replicated five times. The remaining ten buckets served as the control for the two varieties of Cucumber. The ten treatment used is as follow:

$V_1T_1L_1$-Variety one treated with 0.5 g of root grow (Mycorrhizal fungi)

$V_1T_1L_2$- Variety one treated with 1.0 g of root grow Mycorrhizal fungi)

$V_1T_2L_1$- Variety one treated with 50 g of Broiler droppings
$V_1T_2L_2$- Variety one treated with 100 g of Broiler droppings
$V_1C$- Variety one control with no treatment
$V_2T_1L_1$- Variety two treated with 0.5 g of root grow (Mycorrhizal fungi)
$V_2T_1L_2$- Variety two treated with 1.0 g of root grow (Mycorrhizal fungi)
$V_2T_2L_1$- Variety two treated with 50 g of Broiler droppings
V2$T_2L_2$- Variety two treated with 100 g of Broiler droppings
$V_2C$- Variety two control with no treatment

**Field Experiment**

**Field layout**

The Experimental field was sandy loam. The field was plowed, harrowed and ridged. The area of the field was 96 m by 16 m. The field was then divided into four blocks. Each block measures 96 m by 3 m (288 m$^2$). One meter (1 m) alley was made between blocks to avoid interference. Each block was divided into ten plots to accommodate all the treatments, with 1m alley between plots.

**Experimental design**

The experiment was designed as a 2 by 5 factorial fitted into a Randomized Complete Block Design (RCBD) and replicated four times. The two factors considered were two varieties and five treatments, giving a total of ten treatments in a block. The treatments represented in each block are the same as for pot trials.

**Incorporation of root-knot nematodes**

One hundred and twenty kilograms (120 kg) of galled roots chopped into small pieces were inoculated to increase the soil nematode population on the field.

**Planting of seeds**

Cucumber seeds were planted at the rate of three seeds per hole at a depth of 3-4 cm and separated at a distance of 60 cm. The seedlings were thinned to two seedlings per stand before treatments were applied.

**Application of treatment**

Each of the two treatments, root grow (mycorrhizal fungi) and broiler droppings were applied at two different levels. Root-grow (mycorrhizal fungi) was applied at 0.5 g and 1.0 g (the recommended rate by the producer) while the broiler droppings were applied at 50 g and 100 g to all the plots except the control which received no treatment. The treatments were applied twice; a week and four weeks after planting. The plants were weeded regularly to avoid plant-weed competition and to enhance their growth.

**Nematode soil population**

Soil samples were collected from each replicate and sent to the International Institute of Tropical Agriculture (IITA), Ibadan for nematode counting at planting, four weeks after planting and at harvest.

**Data collection and analysis**

The data collected include the number of flowers, fruit yield per pot, root gall rating, soil nematode population. The pot experiment was laid out in Complete Randomised Design (CRD). The Data collected were subjected to Analysis of variance (ANOVA). Where treatment means were significant, multiple comparisons of treatments were done using Tukey's honesty significant difference at 5% level of significance. All statistical analysis was done using IBM SPSS version 21.

**Results and Discussion**

**Effect of variety and test materials on the number of leaves of Cucumber, (*Cucumis sativu*) infected with *M. incognita* in the field and pot conditions.**

**Table 1a**-**1d** shows the effects of varieties and treatments on the mean number of leaves of Cucumber infected with Nematodes on-field and screen house at 1-8 weeks after planting (WAP) respectively. **Table 1a** and **1b** show that there was no varietal effect on mean number of leaves of Cucumber from 1-8 WAP. There were significant differences in the performance of treatment materials from 2-8 WAP (**Table 1a**). Broiler droppings at 100 g had the highest number of leaves followed by Broiler droppings at 50 g at 3,4 and 5 WAP. There were no significant differences between Mycorrhiza fungi at 0.5 g and 1.0 g 3,4 and 8 WAP. There were no significant differences between Broiler droppings at 100 g and 50 g at 2,6,7 and 8 WAP. **Table 1b** shows that there were significant differences between treatments 1-8WAP. There was no significant difference between Broiler droppings at 100 g and Broiler droppings at 50 g 1-6 WAP but the former had a higher number of leaves at 7 and 8 WAP. There was no significant difference between mycorrhiza fungi at 0.5 g and mycorrhiza fungi at 1.0 g from 1-8 WAP. Mycorrhiza fungi at 0.5 g and 1.0 g were not significantly higher than the control except at 1 WAP **Table 1c** and **1d** show that there were significant differences between treatments on the mean number of leaves from 2-8 WAP. Variety two treated with broiler droppings at 100 g performed better than all other treatments at 2-8 WAP. At 2-8 WAP, marketer treated with 100g broiler dropping had significantly the highest number of leaves. This is followed by marketer treated with 50 g broiler droppings and then marketmore treated with 100 g broiler droppings and marketmore treated with 50 g broiler droppings. The least number of leaves were recorded in the marketer and marketmore treated with 0.5g and 0.1g of mycorrhiza fungi. All treatments had a significantly higher number of leaves than control **Table 1c**. **Table 1d** shows that at 2-8 WAP, number of leaves was observed in the following descending order; marketer treated with 100 g broiler droppings, marketer treated with 50 g broiler droppings, marketer treated with 1.0 g mycorrhiza fungi, marketer treated with 0.5 g mycorrhiza fungi, marketmore treated with 100 g broiler dropping. Marketer treated with 100 g broiler droppings has the most significant effect as shown in **Table 1d.**

**Effect of variety and test materials on the length of leaves of Cucumber, (*Cucumis sativus*) infested with *M. incognita* in field and pot conditions.**

**Table 2a-2d** shows the effect of variety and treatment on the length of leaves of Cucumber infested with Nematode on-field and screen-house from 1-8 WAP respectively. Table 2a and 2b show that there was no significant difference between the two varieties of Cucumber on the length of leaves of Cucumber infested with *M. incognita* from 1-8 WAP. There were significant differences between the different treatments in the following descending order: 100 g of broiler droppings, 50 g of broiler droppings, 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi from 1-8 WAP. There was no significant difference between 0.5 g of mycorrhiza fungi and 1.0g of mycorrhiza fungi and the control from 1-6 WAP. 100 g of broiler droppings and 50 g of Broiler droppings were significantly different from the control with 100 g of broilers droppings having higher means in the length of leaves (**Table 2b**). **Table 2c** and **2d** show that significant differences exist between the different treatment materials. All treatments resulted in significantly higher means in the length of leaves of cucumber compared with the untreated control. Marketmore and marketer treated with 100 g of Broiler droppings performed significantly better than marketmore and marketer treated with 50 g of Broiler droppings 6-8 WAP (**Table 2c**). there was no significant difference between marketmore and marketer treated with 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi and the control except in Marketer treated with 0.5 g of mycorrhiza fungi at 4-8 WAP. **Table 2c** shows that there are significant differences between the different treatments. All treatments resulted in significantly higher means in the length of leaves of cucumber compared to the untreated control. Marketmore treated with 100 g broiler dropping and marketer treated with 100 g of broiler dropping performed significantly better than marketmore treated with 50 g broiler dropping and marketer treated with 50 g of broiler droppings 6-8 WAP. There is no significant difference between marketmore treated with 1.0 g mycorrhiza fungi and marketer treated with 1.0 g of mycorrhiza fungi and marketmore treated with 0.5 g mycorrhiza fungi and marketer treated with 0.5 g mycorrhiza fungi and control except in marketer treated with 0.5 g of mycorrhiza fungi at 4-8 WAP.

**Effect of variety and test materials on the breadth of leaves of Cucumber (*Cucumis sativus*) infested with *M. incognita* in the field and pot conditions.**

**Table 3a-3d** shows the effect of variety and treatment on the breadth of leaves of Cucumber infested with Nematode on-field and screen-house from 1-8 WAP respectively. **Table 3a** and **3b** show that there was no significant difference between the two varieties of Cucumber infested with nematode both on the field and in screen-house from 1-8 WAP but significant differences exist between the different treatments. All treatment was significantly different from the control at 1-5 WAP and 7-8 WAP. 100 g of broiler droppings and 50 g of Broiler droppings were not significantly different but 100 g of broiler droppings resulted in higher means of the breadth of leaves than 50 g of Broiler droppings. 1.0 g of mycorrhiza fungi was not significantly different from 0.5 g of mycorrhiza fungi from 1-7 WAP. (**Table 3a**) there were significant differences between 100 g of Broiler droppings and 50 g of broiler droppings at 8 WAP with 100 g of broiler droppings performing significantly better in means of the breadth of leaves than 50 g of broiler droppings. A significant difference exists between 1.0 g and 0.5 g at 8 WAP.

**Table 3c** and **3d** show that there was no significant difference between marketer treated with 100 g and 50 g of mycorrhiza fungi through marketer treated with 100 g of mycorrhiza fungi had a higher mean in the breadth of leaves of cucumber. **Table 3c** showed Significant difference exists between marketmore treated with 100 g of broiler droppings and marketmore treated with 50 g of broiler droppings at 8 WAP. No significant difference was observed between all varieties treated with 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi though marketmore treated with 1.0 g of mycorrhiza resulted in a higher mean of the breadth of leaves 2-8 WAP. Marketer treated with 100 g broiler dropping, marketer treated with 50 g broiler dropping and marketmore treated with 100 g broiler dropping had the highest mean leaf breadth of cucumber. 1-8 WAP marketer treated with 1.0 g mycorrhiza fungi and marketer treated with 0.5 g had same mean leaf breadth as control **Table 3d** further shows marketer treated with 100 g broiler droppings and marketer treated with 50 g broiler droppings had the highest mean leaf breadth. 3-8 WAP marketmore treated with 100 g broiler droppings and marketmore treated with 50 g broiler droppings had higher mean leaf breadth than marketer and marketmore treated with 0.5 g and 1.0 g mycorrhiza fungi. 3-8 WAP marketer and marketmore treated with 0.5 g and 1.0 g mycorrhiza fungi had the same mean leaf breadth as control.

**Effect of variety and test materials on vine length of Cucumber (*Cucumis sativus*) infested with *M. incognita* in the field and pot conditions.**

**Table 4a-4d** shows the effect of variety and treatment on vine length of Cucumber infested with Nematode on-field and screen-house from 1-8 WAP respectively. **Table 4a** and **4b** show that there was no significant difference between the two varieties of cucumber infected with *M. incognita* on vine length both on the field and in the screen-house. **Table 4a** shows that there was no significant difference between 100 g of broiler droppings and 50 g of broiler dropping from 1-8 WAP but 100 g of broiler droppings and 50 g of broiler droppings had significantly higher means in vine length of cucumber infested with nematode compared with the untreated control at 2, 5, 6, 7 and 8 WAP. There was no significant difference between 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi 1-8 WAP but 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi resulted in higher means in vine length than the untreated control at 7 and 8 WAP.

**Table 4c** shows that there was no significant difference between marketmore and marketer treated with 100g of broiler droppings and 50 g of broiler droppings 1-8 WAP though 100 g of broiler droppings had higher values than 50 g of broiler droppings. There was no significant difference between marketmore and marketer treated with 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi. 1-8 WAP through 0.5 g of mycorrhiza fungi had higher values than 1.0 g of mycorrhiza fungi. All treatments resulted in significantly higher means in vine length than the untreated control. 100 g of broiler droppings had the highest mean of vine length followed by 50 g of broiler droppings and then 0.5 g of mycorrhiza fungi and 1.0 g of mycorrhiza fungi. **Table 4d** shows that marketer treated with 100 g broiler droppings and marketer treated with 50 g broiler droppings had the highest vine length of cucumber 4-8 WAP. Marketer and marketermore treated with 0.5 g and 1.0 g mycorrhizal fungi had the same mean vine length of cucumber as control 3-8 WAP.

**Effect of variety and treatment on soil nematode population and root galling of Cucumber infected with nematode on the field and in the screen house.**

**Tables 5a** and **5c** show the mean nematode population before planting, 4 WAP, at harvest and root galling of cucumber infected with *M. incognita* on the field. **Tables 5b** and **5d** show the mean nematode population 2 WAP, 5 WAP, at harvest and root galling of cucumber infested with nematode in a pot trial. **Tables 5a** and **5b** show that there was no significant difference between the two varieties of cucumber infested with nematode both on-field and in pot trial. It was observed that all treatment levels were effective in significantly reducing nematode population and root galling as compared with the control. The reduction was observed in the following descending order at 4 WAP: 100 g of broiler droppings, 50 g of broiler droppings, 0.5 g of mycorrhiza fungi and 1.0 g of mycorrhiza fungi. Reduction in root galling was observed in the following descending order: 100 g of broiler droppings, 50 g of broiler droppings followed by 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi (**Tables 5a** and **5c**). Reduction in both nematode populations at 5 WAP and root galling was observed in the following descending order: 100 g of broiler droppings, 50 g of broiler dropping, 1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi (**5b** and **5d**). **Table 5d,** it was observed that all treatment levels were effective in significantly reducing nematode population and root galling as compared to the control. Reduction in nematode population was best with marketer treated with 100 g broiler droppings 5 WAP. Reduction in root galling was best with marketer treated with 100 g broiler droppings.

Mycorrhiza fungi is a factor to be considered in the growth and disease resistance of plants, as many studies have shown recently. This work shows interesting results about the bio-protective nature of broiler droppings and mycorrhiza fungi (singly and both) on the vegetative growth of *Meloidogyne incognita* infecting cucumbers. Both (broiler droppings and mycorrhiza fungi) either alone or in combination, promoted the number of leaves, leaf length and breadth, vine length and shoot weight of grown cucumber. Results of broiler droppings and root grow (mycorrhiza fungi) tested against *Meloidogyne incognita* on the field and screen-house showed that the treatments applied reduced the population of *Meloidogyne incognita* and root galling of cucumber plants. It was observed that the treatments were effective against root-knot nematode on cucumber at various levels at which they were applied especially on the field. Broiler droppings applied at 100 g and 50 g being more effective than 1.0 g of root grow (mycorrhiza fungi) and 0.5 g of root grow (mycorrhiza fungi).

According to Hassan *et al.,* (2011) who carried out field experiments to test the efficacy of three organic wastes, namely refuse dump (RD), rice husk (RH) and sawdust (SD), for the management of root-knot nematodes, *Meloidogyne spp.,* on tomato. Their results showed that poultry droppings treatment gave the significantly (P = 0.05) highest reduction in the nematode population compared to non-amended treatment. A significant (P = 0.05) increase in the yield of tomato by 17–100% for poultry droppings, 13–84% for sawdust and 21–63% for rice husks were observed. The effectiveness of broiler droppings could be as a result of toxic effect and (or) from the decomposition of organic matter resulting in the formation of toxic product which is toxic to microorganisms including nematodes and the ability of broiler droppings to increase the population of beneficial microorganism in the soil which might be antagonistic to nematodes.

The effectiveness of root grow (mycorrhiza fungi) was probably due to the presence of Arbuscular mycorrhizal fungi present in root grow (mycorrhiza fungi) which is effective against nematode. Arbuscular mycorrhiza forms an association with plants that are common to the cucurbits (Hause *et al.,*2007, Herrera-Medina *et al.,* 2007). It has been suggested that Arbuscular mycorrhiza fungi increase host tolerance to pathogens attack by compensating for the loss of root functional and biomass caused by soil-borne pathogens (Linderman, 1994) including fungi and nematodes (Cordier *et al.,* 1996; Lidan *et al.,* 2008), conducted a pot experiment to evaluate the influence of pre-inoculation of cucumber plants with each of the three arbuscular mycorrhizal (AM) fungi *Glomus intraradices, Glomus mosseae* and *Glomus versiforme* on reproduction of the root-knot nematode *Meloidogyne incognita*, discovered that all three AM fungi tested significantly reduced the root galling index. Results from this study show that growth parameters (the number of leaves, length of leaves, breadth of leaves, vine length) treated with the treatments were significantly increased when compared with the untreated cucumbers.

The effectiveness of broiler droppings was probably due to its richness in nutrients which resulted from the quality of feed of broilers (high in crude protein). Broilers thus can provide sufficient total plant-soil nitrogen. This is following Noling, (2009a) who evaluated poultry litter and manures for root-knot control and as a nitrogen (N) source for squash field plots containing a natural infestation of *Meloidogyne incognita* race 3. His result shows that poultry litter and manure provided sufficient total plant-available soil nitrogen to support growth compared to mineral fertilizers.

The effectiveness of mycorrhiza fungi might be due to its ability to introduce mycorrhiza-associated bacteria. This is in agreement with Bin *et al.*, (2008) who found that mycorrhiza-associated bacteria from the genus *Paenibacillus* have been shown to promote the growth of cucumber plants. It was observed from this study that 100 g of broiler droppings resulted in significantly better growth than 50 g of broiler droppings. This is following Amulu and Adekunle, (2015) who investigated the effects of poultry manure and cow dung in comparison with the nematicide, carbofuran on the yield of okra infested with root-knot nematode *Meloidogyne incognita* Race 2. poultry manure was applied at the rates of 5 and 10 tha-1. The results showed that the highest rates of poultry manure significantly ($P \leq 0.05$) reduced root gall-index and nematode population density in soil and correspondingly increased fruit yield in comparison to those at lower rates and the control.

Observations from this study show that cucumbers that were treated with 100 g of broiler droppings and 50 g of broiler droppings in most cases recorded a significantly higher number of leaves, longer length of leaves and breadth of leaves when compared with cucumbers that were treated with 1.0 g of root grow (mycorrhiza fungi) and 0.5 g of root grow (mycorrhiza fungi) both on-field and screen-house. This might be a result of the difference in the rate of application of broiler droppings and mycorrhiza fungi. The rate of broiler droppings was much higher than that of root grow (mycorrhiza fungi). Reduction in the rate of application of broiler droppings to the same rate as root grow (mycorrhiza fungi) might reduce the performance of broiler droppings while increasing the rate of root-grow (mycorrhiza fungi) to the same as broiler droppings might increase the performance of root grow (mycorrhiza fungi) much more than that of broiler droppings.

Furthermore, observations from this study show that all treatments performed significantly better on the field than in pot which may be because the density of root-knot nematodes is considerably higher in sterile soils when nematodes are added to plants growing on sterile soils than that in most soils (Cheng *et al.*, 2009). The result of this study also shows that there was no varietal difference between the two varieties of cucumber used throughout this experiment.

## CONCLUSION

The study was conducted on the field and in the screen-house, it was discovered that broiler droppings and mycorrhiza fungi were effective in controlling root-knot nematode *meloidogyne incognita* on cucumber. It is therefore concluded that the effect of treatments used in this study is in the following descending order: 100 g of broiler droppings, 50 g of broiler droppings,1.0 g of mycorrhiza fungi and 0.5 g of mycorrhiza fungi. The use of soil amendments such as broiler droppings as an organic matter and root grow (mycorrhiza fungi) has been demonstrated to be effective against root-knot nematode. The use of broiler droppings which are very cheap, readily available and sustainable with minimal negative effect in terms of management of plant-parasitic nematodes, *M. incognita* should be encouraged especially among farmers growing cucumber marketmore and marketer. The use of root grow (mycorrhiza fungi) should be encouraged at higher rates which might probably result in better performance of plants in terms of growth and reduction in nematode population and galling.

**Conflict of Interest**

No conflict of interest among the authors based.

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**Table 1a : Main Effects of Varieties and Treatments on Mean Number of Leaves of Cucumber Infected with Root-Knot Nematode under Field Conditions**

| | Weeks After Planting | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Cucumber Variety** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Mktmore** | 2.95 | 4.92 | 7.00 | 9.09 | 11.6 | 15.34 | 18.93 | 23.54 |
| **Mkter** | 3.01 | 4.98 | 7.24 | 10.59 | 14.09 | 17.72 | 21.8 | 26.14 |
| **SEM** | 0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.5 |
| | NS | NS | NS | NS | NS | NS | NS | NS |
| **Treatment Level** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **MF control** | 2.75 | 4.00c | 5.13d | 6.50d | 7.64d | 9.19c | 11.06c | 12.86c |
| **BD control** | 3.00 | 3.88c | 5.05d | 6.50d | 7.69d | 9.15c | 10.65c | 12.88c |
| **MF 0.5g** | 3.00 | 5.00b | 6.48c | 8.53c | 11.26c | 14.38b | 17.52b | 22.28b |
| **MF 1.0g** | 3.00 | 4.80b | 6.89c | 8.64c | 11.37c | 14.91b | 18.59b | 23.39b |
| **BD 50g** | 3.01 | 5.13ab | 7.95b | 11.89b | 16.13b | 21.29a | 26.15a | 31.94a |
| **BD 100g** | 3.02 | 5.79a | 9.19a | 13.63a | 17.80a | 22.91a | 28.71a | 33.72a |
| **SEM C** | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.8 | 1.1 |
| **SEM Trt** | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.7 |
| | NS | | | | | | | |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 1b: Main Effects of Varieties and Treatments on Mean Number of Leaves of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Cucumber Variety** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Mktmore** | 2.12 | 3.36 | 5.24 | 6.92 | 8.48 | 11 | 15.32 | 18.88 |
| **mkter** | 2.88 | 4.04 | 5.96 | 8.32 | 10.16 | 13.8 | 19.24 | 24.52 |
| **SEM** | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.7 | 1 |
| | NS | NS | NS | NS | NS | NS | NS | NS |
| **Treatment Level** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **MF control** | 2.00c | 3.00c | 4.40b | 5.20b | 6.20b | 7.20b | 8.20c | 8.60c |
| **BD control** | 2.20bc | 3.20bc | 4.20b | 5.60b | 6.80b | 7.80b | 9.20c | 10.40c |
| **MF 0.5g** | 2.70a | 3.60abc | 5.00b | 6.10b | 7.20b | 8.20b | 9.30c | 10.40c |
| **MF 1.0g** | 2.50ab | 3.60abc | 4.80b | 6.20b | 7.20b | 8.30b | 9.90c | 11.60c |
| **BD 50g** | 2.60ab | 4.20a | 7.00a | 10.00a | 12.40a | 18.10a | 26.30b | 33.90b |
| **BD 100g** | 2.60ab | 4.00ab | 6.90a | 10.40a | 13.30a | 20.10a | 32.20a | 43.10a |
| **SEM C** | 0.1 | 0.3 | 0.4 | 0.5 | 0.7 | 0.9 | 1.5 | 2.2 |
| **SEM Trt** | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 1.1 | 1.6 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different usig the Tukey's honesty test at P=0.05*

**Table 1c: Interaction Effects of Varieties and Treatments on Mean Number of Leaves of Cucumber Infected with Root-Knot Nematode under Field Conditions**

| | | Weeks after Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variety** | **Trt Level** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Mktmore control** | **Control** | 2.75 ± 0.3 | 4.00c ± 0.4 | 5.13d ± 0.3 | 6.50f ± 0.3 | 7.64f ± 0.4 | 9.19d ± 0.6 | 11.06f ± 0.4 | 12.86d ± 0.3 |
| **Mkter** | **Control** | 3.00 ± 0.0 | 3.88c ± 0.1 | 5.05d ± 0.1 | 6.50f ± 0.3 | 7.69f ±0.5 | 9.15d ± 0.6 | 10.65f ± 0.3 | 12.88d ± 0.3 |
| **Mktmore** | **MF 0.5g** | 3.00 ± 0.0 | 5.00b ± 0.0 | 6.33cd ± 0.2 | 7.81def ± 0.3 | 10.14e ± 0.2 | 14.00c ± 0.4 | 16.44e ± 1.0 | 20.82c ± 2.3 |
| **Mktmore** | **MF 1.0g** | 3.00 ± 0.0 | 5.00b ± 0.0 | 6.31cd ± 0.2 | 7.69ef ± 0.3 | 9.65ef ± 0.5 | 14.19c ± 0.7 | 16.94de ± 0.9 | 22.06c ± 1.2 |
| **Mktmore** | **BD 50g** | 3.00 ± 0.0 | 5.25b ± 0.3 | 7.93ab ± 0.4 | 11.15bc ± 0.8 | 14.24cd ± 0.8 | 18.96b ± 0.6 | 24.20c ± 0.7 | 30.17b ± 1.3 |
| **Mktmore** | **BD 100g** | 3.01 ± 0.0 | 5.33ab ± 0.2 | 9.30a ± 0.4 | 12.28b ± 0.4 | 16.35bc ± 0.4 | 20.39b ± 0.7 | 26.03bc ±0.8 | 31.81ab ± 0.8 |
| **Mkter** | **MF 0.5g** | 3.00 ± 0.0 | 5.00b ± 0.0 | 6.63bc ± 0.4 | 9.25de ± 0.3 | 12.38d ± 0.4 | 14.75c ± 0.6 | 18.60de ± 0.9 | 23.75c ± 0.9 |
| **Mkter** | **MF 1.0g** | 3.00 ± 0.0 | 4.79bc ± 0.3 | 7.46bc ± 0.2 | 9.59cd ± 0.3 | 13.10d ± 0.2 | 15.63c ± 0.2 | 20.24d ± 0.5 | 24.73c ± 0.8 |
| **Mkter** | **BD 50g** | 3.01 ± 0.0 | 5.00b ± 0.0 | 7.96ab ± 0.3 | 12.63b ± 0.2 | 18.01ab ± 0.1 | 23.63a ± 0.6 | 28.10ab ± 1.2 | 33.70ab ± 0.5 |
| **Mkter** | **BD 100g** | 3.03 ± 0.0 | 6.25a ± 0.1 | 9.08a ± 0.2 | 14.98a ± 0.1 | 19.25a ± 0.4 | 25.43a ± 0.3 | 31.40a ± 0.6 | 35.63a ± 0.7 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 1d: Interaction Effects of Varieties and Treatments on Mean Number of Leaves of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | | Weeks After planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Variety | Trt Level | | | | | | | | |
| Mktmore | Control | 2.00c ± 0.0 | 3.00c ± 0.0 | 4.40cd ± 0.2 | 5.20e ± 0.4 | 6.20d ± 0.2 | 7.20d ± 0.2 | 8.20c ± 0.2 | 8.60c ± 0.2 |
| Mkter | Control | 2.20c ± 0.2 | 3.20c ± 0.2 | 4.20d ± 0.2 | 5.60e ± 0.4 | 6.80d ± 0.4 | 7.80d ± 0.4 | 9.20c ± 0.4 | 10.40c ± 0.4 |
| Mktmore | MF 0.5g | 2.40bc ± 0.2 | 3.20c ± 0.2 | 4.40cd ± 0.2 | 5.40e ± 0.2 | 6.40d ± 0.2 | 7.40d ± 0.2 | 8.20c ± 0.4 | 9.00c ± 0.4 |
| Mktmore | MF 1.0g | 2.00c ± 0.0 | 3.60abc ± 0.2 | 4.80bcd ± 0.2 | 6.00e ± 0.0 | 6.80d ± 0.2 | 7.60d ± 0.2 | 9.20c ± 0.4 | 10.40c ± 0.4 |
| Mktmore | BD 50g | 2.20c ± 0.2 | 3.60abc ± 0.2 | 6.40ab ± 0.4 | 8.80bcd ± 0.8 | 10.80bc ± 1.1 | 15.00c ± 1.3 | 21.80b ± 2.7 | 27.80b ± 3.6 |
| Mktmore | BD 100g | 2.00c ± 0.0 | 3.40bc ± 0.2 | 6.20abc ± 0.5 | 9.20abc ± 0.4 | 12.20ab ± 0.9 | 17.80bc ± 0.9 | 29.20a ± 2.4 | 38.60a ± 3.7 |
| Mkter | MF 0.5g | 3.00ab ± 0.0 | 4.00abc ± 0.0 | 5.60bcd ± 0.2 | 6.80cde ± 0.4 | 8.00cd ± 0.4 | 9.00d ± 0.3 | 10.40c ± 0.2 | 11.80c ± 0.4 |
| Mkter | MF 1.0g | 3.00ab ± 0.0 | 3.60abc ± 0.2 | 4.80bcd ± 0.4 | 6.40de ± 0.5 | 7.60cd ± 0.5 | 9.00d ± 0.4 | 10.60c ± 0.2 | 12.80c ± 0.4 |
| Mkter | BD 50g | 3.00ab ± 0.0 | 4.80a ± 0.4 | 7.60a ± 0.2 | 11.20ab ± 0.7 | 14.00ab ± 1.4 | 21.20ab ± 1.5 | 30.80a ± 1.3 | 40.00a ± 3.9 |
| Mkter | BD 100g | 3.20a ± 0.2 | 4.60ab ± 0.6 | 7.60a ± 0.9 | 11.60a ± 0.8 | 14.40a ± 0.9 | 22.40a ± 1.5 | 35.20a ± 2.1 | 47.60a ± 2.5 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 2a: Main Effects of Varieties and Treatments on Mean Leaf Length (cm) of Cucumber Infected with Root-Knot Nematode under Field Conditions**

| | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Cucumber Variety** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Mktmore** | 5.00a | 7.01a | 9.08a | 10.10a | 11.05a | 11.90a | 12.61a | 13.31a |
| **Mkter** | 4.68a | 6.46a | 8.53a | 10.28a | 11.33a | 12.62a | 13.90a | 14.84a |
| **SEM** | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | NS | NS | NS | NS | NS | NS | NS | NS |
| **Treatment Level** | | | | | | | | |
| **MF control** | 3.00c | 4.43d | 5.55c | 6.65d | 7.41e | 8.70e | 9.20e | 10.10e |
| **BD control** | 3.00c | 3.65e | 4.53d | 6.98d | 8.23d | 8.75e | 9.08e | 9.73e |
| **MF 0.5g** | 5.01b | 6.63c | 9.07b | 10.21c | 10.91c | 11.39d | 12.04d | 12.89d |
| **MF 1.0g** | 5.01b | 6.70c | 9.37b | 10.14c | 11.46c | 12.60c | 13.63c | 14.29c |
| **BD 50g** | 5.56a | 7.71b | 9.77b | 11.49b | 12.27b | 13.46b | 15.08b | 15.99b |
| **BD 100g** | 5.65a | 8.60a | 10.79a | 12.31a | 13.49a | 15.14a | 16.37a | 17.30a |
| **SEM C** | 0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| **SEM Trt** | 0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 2b: Main Effects of Varieties And Treatments on Mean Leaf Length (cm) of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Cucumber Variety** | | | | | | | | |
| **Marketmore** | 3.33 | 4.11 | 5.03 | 5.9 | 6.55 | 7.27 | 7.95 | 8.62 |
| **Marketer** | 3.36 | 4.47 | 5.92 | 6.7 | 7.46 | 8.13 | 8.82 | 9.66 |
| **SEM** | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 |
| | NS | NS | NS | NS | NS | NS | NS | NS |
| **Treatment Level** | | | | | | | | |
| **MF control** | 3.10b | 3.62c | 4.10b | 4.44b | 5.00b | 5.42bc | 5.90bc | 6.20d |
| **BD control** | 3.04b | 3.50c | 3.90b | 4.34b | 4.84b | 5.10c | 5.52c | 5.94d |
| **MF 0.5g** | 3.26ab | 4.07bc | 4.72b | 5.50b | 5.97b | 6.38b | 6.81b | 7.32c |
| **MF 1.0g** | 3.08b | 3.77c | 4.60b | 5.00b | 5.36b | 5.84bc | 6.36bc | 6.90cd |
| **BD 50g** | 3.55ab | 5.11a | 7.10a | 8.30a | 9.33a | 10.18a | 11.08a | 11.96b |
| **BD 100g** | 3.67a | 4.94ab | 6.95a | 8.31a | 9.44a | 10.84a | 11.97a | 13.46a |
| **SEM C** | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 |
| **SEM Trt** | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 |

**Table 2c**: **Interaction Effects of Varieties and Treatments on Mean Leaf Length (cm) of Cucumber Infected with Root-Knot Nematode Under Field Conditions**

| | | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variety** | **Trt Level** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Mktmore** | **Control** | 3.00d ± 0.0 | 4.43c ± 0.2 | 5.55c ± 0.2 | 6.65e ± 0.2 | 7.41h ± 0.2 | 8.70f ± 0.3 | 9.20f ± 0.2 | 10.10h ± 0.1 |
| **Mkter** | **Control** | 3.00d ± 0.0 | 3.65c ± 0.1 | 4.53d ± 0.2 | 6.98e ± 0.4 | 8.23g± 0.1 | 8.75f ± 0.1 | 9.08f ± 0.1 | 9.73h ± 0.1 |
| **Mktmore** | **MF 0.5g** | 5.01c ± 0.1 | 6.78b ± 0.3 | 9.23b ± 0.2 | 10.13d ± 0.1 | 10.51f ± 0.3 | 11.10e ± 0.2 | 11.70e ± 0.2 | 12.60g ± 0.2 |
| **Mktmore** | **MF 1.0g** | 5.00c ± 0.0 | 6.73b ± 0.2 | 9.09b ± 0.2 | 9.72d ± 0.1 | 11.21ef± 0.1 | 12.45cd ± 0.2 | 13.24d ± 0.1 | 13.78ef ± 0.1 |
| **Mktmore** | **BD 50g** | 6.01a ± 0.0 | 8.60a ± 0.2 | 10.85a ± 0.2 | 11.56abc ± 0.1 | 12.04cd ± 0.2 | 12.51c ± 0.2 | 13.63d ± 0.3 | 14.33de ± 0.2 |
| **Mktmore** | **BD 100g** | 6.00a ± 0.0 | 8.50a ± 0.2 | 10.70a ± 0.1 | 12.46a ± 0.3 | 14.09a ± 0.1 | 14.75ab ± 0.1 | 15.28c ± 0.1 | 15.73c ± 0.1 |
| **Mkter** | **MF 0.5g** | 5.00c ± 0.0 | 6.48b ± 0.2 | 8.91a ± 0.3 | 10.30d ± 0.1 | 11.32de ± 0.1 | 11.68de ± 0.1 | 12.38e ± 0.1 | 13.18fg ± 0.3 |
| **Mkter** | **MF 1.0g** | 5.01c ± 0.0 | 6.68b ± 0.1 | 9.65b ± 0.1 | 10.56cd ± 0.1 | 11.71de ± 0.1 | 12.75c ± 0.1 | 14.02d ± 0.0 | 14.80d ± 0.0 |
| **Mkter** | **BD 50g** | 5.10c ± 0.1 | 6.81b ± 0.0 | 8.69b ± 0.2 | 11.41bc ± 0.2 | 12.50bc ± 0.2 | 14.40b ± 0.1 | 16.54b ± 0.2 | 17.65b ± 0.1 |
| **Mkter** | **BD 100g** | 5.30b ± 0.1 | 8.70a ± 0.1 | 10.89a ± 0.1 | 12.17ab ± 0.2 | 12.90b ± 0.0 | 15.52a ± 0.2 | 17.47a ± 0.2 | 18.87a ± 0.1 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 2d: Interaction Effects of Varieties and Treatments on Mean Leaf Length (cm) of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variety** | **Trt Level** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Mktmore** | **Control** | 3.10c ± 0.1 | 3.62c ± 0.2 | 4.10d ± 0.3 | 4.44e ± 0.3 | 5.00d ± 0.3 | 5.42d ± 0.3 | 5.90de ± 0.2 | 6.20e ± 0.2 |
| **Mkter** | **Control** | 3.04c ± 0.2 | 3.50c ± 0.2 | 3.90d ± 0.3 | 4.34e ± 0.2 | 4.84d ± 0.2 | 5.10d ± 0.2 | 5.52e ± 0.2 | 5.94e ± 0.3 |
| **Mktmore** | **MF 0.5g** | 3.12c ± 0.8 | 3.88c ± 0.1 | 4.28d ± 0.1 | 4.90de ± 0.2 | 5.40cd ± 0.2 | 5.86cd ± 0.2 | 6.26de ± 0.2 | 6.76de ± 0.2 |
| **Mktmore** | **MF 1.0g** | 3.12c ± 0.8 | 3.90c ± 0.2 | 4.70cd ± 0.2 | 5.02de ± 0.1 | 5.24d ± 0.1 | 5.52d ± 0.1 | 5.92de ± 0.2 | 6.24e ± 0.2 |
| **Mktmore** | **BD 50g** | 3.78ab ± 0.2 | 4.86ab ± 0.3 | 6.30b ± 0.6 | 7.40c ± 0.6 | 8.42b ± 0.6 | 9.20b ± 0.4 | 10.08b ± 0.4 | 10.82b ± 0.5 |
| **Mktmore** | **BD 100g** | 3.36bc ± 0.2 | 4.28bc ± 0.4 | 5.76bc ± 0.6 | 7.76bc ± 0.3 | 8.70b ± 0.4 | 10.36a ± 0.4 | 11.58a ± 0.2 | 13.08a ± 0.3 |
| **Mkter** | **MF 0.5g** | 3.40bc ± 0.2 | 4.26bc ± 0.3 | 5.16bcd ± 0.3 | 6.10d ± 0.4 | 6.54c ± 0.4 | 6.90c ± 0.4 | 7.36c ± 0.3 | 7.88c ± 0.3 |
| **Mkter** | **MF 1.0g** | 3.04c ± 0.1 | 3.64c ± 0.3 | 4.50cd ± 0.3 | 4.98de ± 0.4 | 5.48cd ± 0.3 | 6.16cd ± 0.3 | 6.80cd ± 0.2 | 7.56cd ± 0.2 |
| **Mkter** | **BD 50g** | 3.32bc ± 0.2 | 5.36a ± 0.2 | 7.90a ± 0.7 | 9.20a ± 0.7 | 10.24a ± 0.8 | 11.16a ± 0.7 | 12.08a ± 0.6 | 13.10a ± 0.6 |
| **Mkter** | **BD 100g** | 3.98a ± 0.0 | 5.60a ± 0.2 | 8.14a ± 0.5 | 8.86ab ± 0.5 | 10.18a ± 0.4 | 11.32a ± 0.3 | 12.36a ± 0.3 | 13.84a ± 0.2 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 3a: Main Effects of Varieties and Treatments on Mean Leaf Breadth (cm) of Cucumber Infected with Root-Knot Nematode Under Field Conditions**

| | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Cucumber Variety** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Mktmore** | 4.84a | 6.58a | 8.27a | 9.21a | 9.94a | 10.60a | 11.17a | 11.92a |
| **Mkter** | 4.96a | 6.68a | 8.36a | 9.52a | 10.38a | 11.23a | 12.16a | 13.13a |
| **SEM** | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | NS | NS | NS | NS | NS | NS | NS | NS |
| **Treatment Level** | | | | | | | | |
| **MF control** | 3.38b | 4.90c | 6.23b | 7.33c | 8.15c | 9.18cd | 9.83c | 10.28c |
| **BD control** | 3.33b | 4.73c | 5.95b | 6.80c | 7.55c | 8.23d | 8.85c | 9.50c |
| **MF 0.5g** | 5.02a | 6.77ab | 8.42a | 9.55b | 10.52ab | 11.11ab | 11.81b | 12.34b |
| **MF 1.0g** | 4.79a | 6.45b | 8.46a | 9.00b | 9.85b | 10.74bc | 11.58b | 12.43b |
| **BD 50g** | 5.28a | 6.99ab | 8.91a | 10.19ab | 10.70ab | 11.51ab | 12.20ab | 13.46ab |
| **BD 100g** | 6.06a | 8.13a | 9.70a | 11.03a | 11.89a | 12.50a | 13.40a | 14.51a |
| **SEM C** | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 |
| **SEM Trt** | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 3b: Main Effects of Varieties and Treatments on Mean Leaf Breadth (cm) of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Cucumber Variety** | | | | | | | | |
| **Mktmore** | 2.89 | 4.18 | 5.8 | 6.74 | 7.52 | 8.4 | 9.02 | 9.66 |
| **mkter** | 2.92 | 4.3 | 6.16 | 7.25 | 8.05 | 9.04 | 9.64 | 10.45 |
| **SEM** | 0.1 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 |
| | NS | NS | NS | NS | NS | NS | NS | Ns |
| **Treatment Level** | | | | | | | | |
| **MF control** | 1.94c | 3.46b | 4.28b | 4.76b | 5.12b | 5.48b | 5.64c | 5.92d |
| **BD control** | 2.54bc | 3.40b | 3.90b | 4.58b | 5.02b | 5.36b | 5.82c | 6.36d |
| **MF 0.5g** | 2.82ab | 3.73ab | 4.78b | 5.64b | 6.13b | 6.81b | 7.32bc | 7.83c |
| **MF 1.0g** | 2.97ab | 4.03ab | 5.62ab | 6.31b | 6.84b | 7.22b | 7.73b | 8.30c |
| **BD 50g** | 3.19a | 4.93ab | 7.66a | 9.04a | 10.16a | 11.44a | 12.15a | 13.15b |
| **BD 100g** | 3.31a | 5.09a | 7.75a | 9.31a | 10.71a | 12.71a | 13.72a | 14.85a |
| **SEM C** | 0.2 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.5 | 0.4 |
| **SEM Trt** | 0.1 | 0.3 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 3c: Interaction Effects of Varieties and Treatments on Mean Leaf Breadth (cm) of Cucumber Infected with Root-Knot Nematode Under Field Conditions**

| | | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variety** | **Trt Level** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Mktmore** | **Control** | 3.38b ± 0.2 | 4.90c ± 0.2 | 6.23b ± 0.4 | 7.33de ± 0.2 | 8.15de ± 0.4 | 9.18cd ± 0.3 | 9.83de ± 0.3 | 10.28de ± 0.3 |
| **Mkter** | **Control** | 3.33b ± 0.3 | 4.73c ± 0.2 | 5.95b ± 0.0 | 6.80e ± 0.1 | 7.55e ± 0.2 | 8.23d ± 0.2 | 8.85e ± 0.2 | 9.50e ± 0.2 |
| **Mktmore** | **MF 0.5g** | 5.38a ± 0.5 | 7.38ab ± 0.6 | 9.06a ± 0.8 | 9.92abc ± 0.5 | 10.61abc ± 0.7 | 10.87abc ± 0.7 | 11.18bcd ± 0.7 | 11.49cde ± 0.6 |
| **Mktmore** | **MF 1.0g** | 4.90ab ± 0.3 | 6.58abc ± 0.5 | 8.69a ± 0.3 | 9.21bc ± 0.5 | 10.00bcd ± 0.4 | 10.50bc ± 0.4 | 11.10bcd ± 0.3 | 11.65cd ± 0.3 |
| **Mktmore** | **BD 50g** | 4.50ab ± 0.3 | 6.15bc ± 0.7 | 8.00ab ± 0.7 | 8.90cd ± 0.5 | 9.45cde ± 0.6 | 10.33bcd ± 0.8 | 10.85cde ± 0.7 | 12.35bc ± 0.6 |
| **Mktmore** | **BD 100g** | 6.03a ± 0.5 | 7.88ab ± 0.5 | 9.38a ± 0.6 | 10.70ab ± 0.4 | 11.50ab ± 0.4 | 12.13ab ± 0.4 | 12.90ab ± 0.2 | 13.85ab ± 0.1 |
| **Mkter** | **MF 0.5g** | 4.65ab ± 0.5 | 6.15bc ± 0.5 | 7.78ab ± 0.5 | 9.18bc ± 0.2 | 10.43abc ± 0.3 | 11.35abc ± 0.3 | 12.45abc ± 0.3 | 13.20abc ± 0.3 |
| **Mkter** | **MF 1.0g** | 4.68ab ± 0.1 | 6.33abc ± 0.2 | 8.23ab ± 0.2 | 8.80cd ± 0.1 | 9.70bcd ± 0.1 | 10.98abc ± 0.4 | 12.05abc ± 0.5 | 13.20abc ± 0.7 |
| **Mkter** | **BD 50g** | 6.05a ± 0.4 | 7.83ab ± 0.4 | 9.83a ± 0.3 | 11.48a ± 0.4 | 11.95a ± 0.4 | 12.70a ± 0.3 | 13.55a ± 0.3 | 14.58a ± 0.4 |
| **Mkter** | **BD 100g** | 6.10a ± 0.4 | 8.38a ± 0.4 | 10.03a ± 0.5 | 11.35a ± 0.3 | 12.28a ± 0.4 | 12.88a ± 0.4 | 13.90a ± 0.3 | 15.18a ± 0.1 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 3d: Interaction Effects of Varieties and Treatments on Mean Leaf Breadth (cm) of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variety** | **Trt Level** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Mktmore** | **Control** | 1.94c ± 0.0 | 3.46 ± 0.2 | 4.28c ± 0.5 | 4.76e ± 0.6 | 5.12b ± 0.6 | 5.48b ± 0.6 | 5.64d ± 0.4 | 5.92d ± 0.4 |
| **Mkter** | **Control** | 2.54bc ± 0.2 | 3.4 ± 0.1 | 3.90c ± 0.1 | 4.58e ± 0.3 | 5.02b ± 0.3 | 5.36b ± 0.3 | 5.82cd ± 0.3 | 6.36d ± 0.2 |
| **Mktmore** | **MF 0.5g** | 3.18ab ± 0.1 | 3.64 ± 0.1 | 4.24c ± 0.1 | 4.94e ± 0.2 | 5.38b ± 0.2 | 6.10b ± 0.1 | 6.66cd ± 0.1 | 7.08cd ± 0.1 |
| **Mktmore** | **MF 1.0g** | 3.00ab ± 0.0 | 3.9 ± 0.3 | 5.94abc ± 0.2 | 6.76bcde ± 0.2 | 7.16b ± 0.3 | 7.52b ± 0.4 | 8.12c ± 0.3 | 8.44c ± 0.3 |
| **Mktmore** | **BD 50g** | 3.22ab ± 0.2 | 5.14 ± 0.6 | 7.74ab ± 0.9 | 8.70abc ± 0.8 | 9.88a ± 0.9 | 10.82a ± 1.1 | 11.46b ±1.0 | 12.42b ± 0.6 |
| **Mktmore** | **BD 100g** | 3.12ab ± 0.0 | 4.78 ± 0.4 | 6.80abc ± 0.7 | 8.52abcd ± 0.5 | 10.04a ± 0.6 | 12.06a ± 0.9 | 13.22ab ± 0.8 | 14.44a ± 0.6 |
| **Mkter** | **MF 0.5g** | 2.46bc ± 0.3 | 3.82 ± 0.4 | 5.32bc ± 0.5 | 6.34cde ± 0.6 | 6.88b ± 0.6 | 7.52b ± 0.4 | 7.98c ± 0.3 | 8.58c ± 0.2 |
| **Mkter** | **MF 1.0g** | 2.94ab ± 0.0 | 4.16 ± 0.6 | 5.30bc ± 0.4 | 5.86de ± 0.5 | 6.52b ± 0.4 | 6.92b ± 0.3 | 7.34cd ± 0.3 | 8.16c ± 0.2 |
| **Mkter** | **BD 50g** | 3.16ab ± 0.2 | 4.72 ± 0.8 | 7.58ab ± 1.2 | 9.38ab ± 0.9 | 10.44a ± 0.7 | 12.06a ± 0.5 | 12.84ab ± 0.4 | 13.88ab ± 0.3 |
| **Mkter** | **BD 100g** | 3.50a ± 0.2 | 5.4 ± 0.5 | 8.7a ± 0.8 | 10.10a ± 0.6 | 11.38 ± 0.7 | 13.36a ± 0.3 | 14.22a ± 0.3 | 15.26a ± 0.1 |
| | | | NS | | | | | | |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 4a: Main Effects of Varieties and Treatments on Mean Vine Length (cm) of Cucumber Infected with Root-Knot Nematode under Field Conditions**

| | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Cucumber Variety** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Mktmore** | 6.06 | 8.83 | 11.6 | 15.23 | 25.86 | 38.89 | 52.07 | 65.64 |
| **Mkter** | 5.99 | 8.99 | 11.64 | 14.75 | 25.1 | 43.25 | 55.03 | 69.65 |
| **SEM** | 0.2 | 0.6 | 1 | 1.5 | 2.2 | 2.8 | 2.4 | 2.8 |
| | NS | NS | NS | NS | NS | NS | NS | NS |
| **Treatment Level** | | | | | | | | |
| **Mktmore control** | 3.99bc | 5.71b | 7.13b | 8.98 | 13.85b | 18.33bc | 22.93c | 29.00c |
| **Mkter control** | 3.60a | 5.63b | 6.96b | 8.93 | 11.09b | 13.63b | 19.13c | 22.28c |
| **MF 0.5g** | 6.28a | 9.01ab | 11.17ab | 13.87 | 24.93ab | 40.56ab | 49.38b | 67.85b |
| **MF 1.0g** | 5.91ab | 8.15ab | 11.02ab | 14.52 | 23.16ab | 38.91ab | 53.49b | 73.73ab |
| **BD 50g** | 7.29a | 10.92a | 13.93ab | 17.6 | 33.00a | 51.09a | 65.12ab | 80.34ab |
| **BD 100g** | 6.84a | 10.80a | 14.93a | 19.98 | 33.83a | 58.83a | 78.74a | 90.66a |
| **SEM C** | 0.6 | 1.4 | 2.2 | 3.2 | 4.9 | 6.3 | 5.5 | 6.3 |
| **SEM Trt** | 0.4 | 1 | 1.5 | 2.3 | 3.4 | 4.5 | 3.9 | 4.5 |
| | | | | NS | | | | |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 4b: Main Effects of Varieties and Treatments on Vine Length (cm) of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Cucumber Variety** | | | | | | | | |
| **Marketmore** | 3.76 | 4.72 | 6.97 | 10.18 | 14.87 | 25.21 | 36.56 | 49.23 |
| **marketer** | 3.76 | 4.27 | 8.1 | 12.86 | 20 | 30.58 | 41.08 | 54.69 |
| **SEM** | 0.2 | 0.4 | 0.5 | 1 | 1.7 | 2.8 | 2.2 | 2.4 |
| | NS | NS | NS | NS | NS | NS | NS | NS |
| **Treatment Level** | | | | | | | | |
| **MF control** | 3.76 | 4.26 | 6.10bc | 7.20b | 8.28b | 9.98b | 11.18b | 12.30c |
| **BD control** | 2.82 | 4 | 5.04c | 6.06b | 7.00b | 8.36b | 9.80b | 12.42b |
| **MF 0.5g** | 3.78 | 4.38 | 6.63bc | 7.60b | 9.68b | 11.85b | 13.70b | 16.64b |
| **MF 1.0g** | 3.5 | 3.98 | 6.03bc | 7.52b | 8.96b | 11.26b | 14.01b | 17.70b |
| **BD 50g** | 3.88 | 5.37 | 10.65a | 17.90a | 29.77a | 50.72a | 75.20a | 101.70a |
| **BD 100g** | 3.4 | 4.61 | 8.79ab | 17.95a | 31.12a | 56.48a | 80.70a | 111.40a |
| **SEM C** | 0.4 | 0.4 | 1.1 | 2.3 | 3.7 | 6.2 | 5 | 5.4 |
| **SEM Trt** | 0.3 | 0.3 | 0.8 | 1.6 | 2.6 | 4.4 | 3.5 | 3.8 |
| | NS | NS | | | | | | |

**Table 4c: Interaction Effects Of Varieties And Treatments On Vine Length (cm) Of Cucumber Infected With Root-Knot Nematode Under Field Conditions**

| | | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Variety** | **Trt Level** | | | | | | | | |
| **Mktmore** | **Control** | 3.99bc ± 0.7 | 5.71 ± 0.4 | 7.13 ± 0.3 | 8.98 ± 0.4 | 13.85ab ± 0.9 | 18.33bc ± 1.0 | 22.93cd ± 1.3 | 29.00b ± 1.3 |
| **Mkter** | **Control** | 3.60c ± 0.2 | 5.63 ± 0.6 | 6.96 ± 0.7 | 8.93 ± 0.4 | 11.09b ± 0.5 | 13.63c ± 0.6 | 19.13d ± 0.7 | 22.28b ± 0.8 |
| **Mktmore** | **MF 0.5g** | 6.26abc ± 0.4 | 9.55 ± 1.1 | 11.56 ± 1.1 | 14.72 ± 1.0 | 27.64ab ± 4.3 | 41.94abc ± 6.4 | 48.94bc ± 7.2 | 63.75a ± 9.3 |
| **Mktmore** | **MF 1.0g** | 6.20abc ± 0.7 | 9.15 ± 1.3 | 11.9 ± 1.6 | 14.31 ± 1.9 | 24.64ab ± 3.6 | 36.01abc ± 3.6 | 53.00b ± 6.7 | 69.20a ± 6.4 |
| **Mktmore** | **BD 50g** | 6.75a ± 0.3 | 9.74 ± 0.9 | 13.13 ± 2.1 | 16.61 ± 3.7 | 29.93ab ± 6.7 | 46.56ab ± 4.9 | 63.99ab ± 6.8 | 79.01a ± 9.4 |
| **Mktmore** | **BD 100g** | 7.08a ± 0.6 | 9.98 ± 0.9 | 14.3 ± 2.3 | 21.5 ± 4.8 | 33.23ab ± 7.5 | 51.63a ± 9.6 | 71.50ab ± 5.8 | 87.23a ± 6.5 |
| **Mkter** | **MF 0.5g** | 6.29ab ± 0.4 | 8.46 ± 1.0 | 10.78 ± 0.5 | 13.03 ± 0.5 | 22.23ab ± 2.8 | 39.18abc ± 4.3 | 49.83b ± 3.1 | 71.95a ± 6.0 |
| **Mkter** | **MF 1.0g** | 5.63abc ± 0.4 | 7.15 ± 0.5 | 10.15 ± 0.7 | 14.72 ± 1.6 | 21.69ab ± 2.4 | 41.80abc ± 4.0 | 53.98b ± 4.7 | 78.25a ± 6.5 |
| **Mkter** | **BD 50g** | 7.84a ± 0.3 | 12.1 ± 1.6 | 14.74 ± 2.7 | 18.6 ± 4.5 | 36.06a ± 4.8 | 55.63a ± 7.4 | 66.25ab ± 8.3 | 81.68a ± 6.3 |
| **Mkter** | **BD 100g** | 6.60ab ± 1.0 | 11.63 ± 3.2 | 15.57 ± 5.0 | 18.46 ± 6.4 | 34.44ab ± 8.1 | 66.03a ± 11.9 | 85.98a ± 4.1 | 94.09a ± 4.4 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 4d: Interaction Effects of Varieties and Treatments on Vine Length (cm) of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| | | Weeks After Planting (WAP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variety** | **Trt Level** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Mktmore** | **control** | 3.76 ± 0.4 | 4.26ab ± 0.4 | 6.10bc ± 0.5 | 7.20cd ± 0.7 | 8.28c ± 0.8 | 9.98c ± 0.6 | 11.18b ± 0.4 | 12.30b ± 0.3 |
| **Mkter** | **control** | 2.82 ± 0.3 | 4.00b ± 0.4 | 5.04c ± 0.3 | 6.06d ± 0.3 | 7.00c ± 0.2 | 3.36c ± 0.3 | 9.80b ± 0.4 | 12.42b ± 0.2 |
| **Mktmore** | **MF 0.5g** | 3.56 ± 0.3 | 4.22ab ± 0.4 | 5.40c ± 0.4 | 6.28d ±0.4 | 7.20c ± 0.4 | 9.30c ± 0.3 | 11.00b ± 0.3 | 13.04b ± 0.5 |
| **Mktmore** | **MF 1.0g** | 3.84 ± 0.4 | 4.36ab ± 0.4 | 5.18c ± 0.3 | 6.72cd ± 0.5 | 8.08c ± 0.6 | 9.66c ± 0.5 | 12.22b ± 0.7 | 14.80b ± 1.2 |
| **Mktmore** | **BD 50g** | 4.22 ± 0.4 | 6.14a ± 0.3 | 11.30a ± 1.7 | 18.30ab ± 2.5 | 29.78ab ± 5.7 | 53.64a ± 11.3 | 74.40a ± 9.1 | 96.20a ± 9.9 |
| **Mktmore** | **BD 100g** | 3.44 ± 0.4 | 4.60ab ± 0.4 | 6.88abc ± 0.2 | 12.40bcd ± 1.4 | 20.50bc ± 3.4 | 43.46ab ±8.6 | 74.00a ± 4.2 | 109.80a ± 8.6 |
| **Mkter** | **MF 0.5g** | 4.00 ± 0.5 | 4.54ab ± 0.6 | 7.86abc ± 0.7 | 8.92bcd ± 0.8 | 11.66c ± 1.5 | 14.40bc ± 2.2 | 16.40b ± 2.3 | 20.24b ± 2.8 |
| **Mkter** | **MF 1.0g** | 3.16 ± 0.4 | 3.60b ± 0.4 | 6.88abc ± 0.9 | 8.32bcd ± 1.2 | 9.84c ± 1.1 | 12.86c ± 0.7 | 15.80b ± 0.8 | 20.60b ± 1.3 |
| **Mkter** | **BD 50g** | 3.54 ± 0.3 | 4.60ab ± 0.6 | 10.00abc ± 2.1 | 17.50abc ± 5.3 | 29.76ab ± 7.7 | 47.80a ± 10.2 | 76.00a ± 10.7 | 107.20a ± 6.7 |
| **Mkter** | **BD 100g** | 3.36 ± 0.4 | 4.62ab ± 0.5 | 10.70ab ± 1.6 | 23.50a ± 3.6 | 41.74a ± 5.6 | 69.50a ± 8.2 | 87.40a ± 5.1 | 113.00a ± 8.1 |
| | | NS | | | | | | | |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05.*

**Table 5a: Main Effects of Varieties and Treatments on Nematode Population (100ml Soil) before Planting, 4 Weeks after Planting, at Harvest and Root Galling of Cucumber Infected with Root-Knot Nematode Under Field Conditions**

| Cucumber Variety | Nematode population before planting | Nematode population 4 WAP | Nematode population at harvest | Root galling |
|---|---|---|---|---|
| **Marketmore** | 151.15 | 154.6 | 224.4 | 5.8 |
| **Marketer** | 147.2 | 154.85 | 237 | 5.65 |
| **SEM** | 20 | 5.5 | 6.3 | 0.1 |
| | NS | NS | Ns | NS |
| **Treatment Level** | | | | |
| **MF control** | 161.50b | 418.75b | 657.25b | 8.00c |
| **BD control** | 143.50a | 447.75b | 690.25b | 8.00c |
| **MF 0.5 g** | 148.75ab | 93.00a | 118.50a | 5.75b |
| **MF 1.0 g** | 146.00a | 96.38a | 120.38a | 5.75b |
| **BD 50 g** | 143.00a | 82.25a | 121.88a | 4.6a |
| **BD 100 g** | 155.63ab | 68.75a | 119.00a | 4.5a |
| **SEM C** | 4.4 | 12.3 | 14 | 0.2 |
| **SEM Tr** | 3.1 | 8.7 | 9.9 | 0.2 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 5b: Main Effects of Varieties and Treatments on Nematode Population (100 ml Soil) 2 WAP Planting, 5 Weeks after Planting, at Harvest and Root Galling Of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| Cucumber Variety | Nematode population 2 WAP | Nematode population 5 WAP | Nematode population at harvest | Root galling |
|---|---|---|---|---|
| **Marketmore** | 147.84 | 115.32 | 167.6 | 4.68 |
| **Marketer** | 147.08 | 107.52 | 171.52 | 4.56 |
| **SEM** | 1 | 2.8 | 4.5 | 0.1 |
| | NS | NS | | |
| **Treatment Level** | | | | |
| **MF control** | 148.8 | 322c | 480.60b | 6.60d |
| **BD control** | 148.6 | 306.60c | 512.40b | 6.40d |
| **MF 0.5g** | 147.7 | 75.70b | 90.70a | 4.70c |
| **MF 1.0g** | 147.8 | 73.90b | 92.20a | 4.50bc |
| **BD 50g** | 145.7 | 51.30a | 82.30a | 3.80ab |
| **BD 100g** | 147.4 | 41.70a | 86.10a | 3.6a |
| **SEM C** | 2.2 | 6.3 | 10 | 0.2 |
| **SEM Trt** | 2 | 4.4 | 7 | 6.2 |
| | NS | | | |

**Table 5c: Interaction Effects of Varieties and Treatments on Nematode Population (100ml Soil) before Planting, 4 Weeks after Planting, at Harvest And Root Galling of Cucumber Infected with Root-Knot Nematode Under Field Conditions**

| Variety | Trt Level | Nematode population before planting | Nematode population 4 WAP | Nematode population at harvest | Root galling |
|---|---|---|---|---|---|
| **Mktmore** | **Control** | 161.50 ± 3.4 | 418.75b ± 20.9 | 657.25b ± 14.4 | 8.00c ± 0.0 |
| **Mkter** | **Control** | 143.50 ± 2.2 | 447.75b ± 31.12 | 690.25b ± 38.6 | 8.00c ± 0.0 |
| **Mktmore** | **MF 0.5g** | 156.00 ± 5.0 | 96.25a ± 2.3 | 114.00a ± 5.7 | 5.75b ± 0.3 |
| **Mktmore** | **MF 1.0g** | 146.00 ± 2.2 | 99.00a ± 2.6 | 113.00a ± 6.4 | 5.75b ± 0.3 |
| **Mktmore** | **BD 50g** | 143.75 ± 5.6 | 87.75a ± 5.1 | 119.75a ± 8.5 | 4.75ab ± 0.3 |
| **Mktmore** | **BD 100g** | 148.50 ± 8.8 | 71.25a ± 3.2 | 118.00a ± 6.1 | 4.75ab ± 0.3 |
| **Mkter** | **MF 0.5g** | 141.50 ± 4.0 | 89.75a ± 3.6 | 123.00a ± 3.0 | 5.75b ± 0.3 |
| **Mkter** | **MF 1.0g** | 146.00 ± 2.3 | 93.75a ± 5.4 | 127.75a ± 3.0 | 5.75b ± 0.3 |
| **Mkter** | **BD 50g** | 142.25 ± 3.4 | 76.75a ± 2.7 | 124.00a ± 3.8 | 4.50a ± 0.3 |
| **Mkter** | **BD 100g** | 162.75 ± 2.9 | 66.25a ± 2.4 | 120.00a ± 6.5 | 4.25a ± 0.3 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*

**Table 5d: Interaction Effects of Varieties and Treatments On Nematode Population (100ml Soil) 2 WAP Planting, 5 Weeks after Planting, at Harvest and Root Galling of Cucumber Infected with Root-Knot Nematode (Pot Trials)**

| Variety | Trt Level | Nematode population 2 WAP | Nematode population 5 WAP | Nematode population at harvest | Root galling |
|---|---|---|---|---|---|
| **Mktmore** | **Control** | 148.80 ± 1.2 | 322.40e ± 13.9 | 480.60b ± 25.5 | 6.60c ± 0.2 |
| **Mkter** | **Control** | 148.60 ± 1.9 | 306.60e ± 12.0 | 512.40b ± 12.9 | 6.40c ± 0.2 |
| **Mktmore** | **MF 0.5g** | 148.20 ± 0.0 | 80.00d ± 3.1 | 94.00a ± 6.4 | 4.60b ± 0.2 |
| **Mktmore** | **MF 1.0g** | 149.40 ± 0.0 | 76.80cd ± 2.4 | 90.40a ± 2.9 | 4.60b ± 0.2 |
| **Mktmore** | **BD 50g** | 146.00 ± 0.0 | 55.20abcd ± 3.4 | 86.60a ± 6.9 | 3.80ab ± 0.2 |
| **Mktmore** | **BD 100g** | 146.8 ± 0.0 | 42.20ab ± 1.6 | 86.40a ± 2.5 | 3.80ab ± 0.2 |
| **Mkter** | **MF 0.5g** | 147.20 ± 0.0 | 71.40bcd ± 3.5 | 87.40a ± 4.5 | 4.80b ± 0.2 |
| **Mkter** | **MF 1.0g** | 146.20 ± 0.0 | 71.00bcd ± 2.6 | 94.00a ± 3.1 | 4.40ab ± 0.2 |
| **Mkter** | **BD 50g** | 145.40 ± 0.1 | 47.40abc ± 2.6 | 78.00a ± 5.7 | 3.80ab ± 0.2 |
| **Mkter** | **BD 100g** | 148.00 ± 0.1 | 41.20a ± 1.4 | 85.80a ± 3.0 | 3.40a ± 0.2 |

*Each value is a mean of five replicates. The figures with the same letter in the same column are not significantly different using the Tukey's honesty test at P=0.05*